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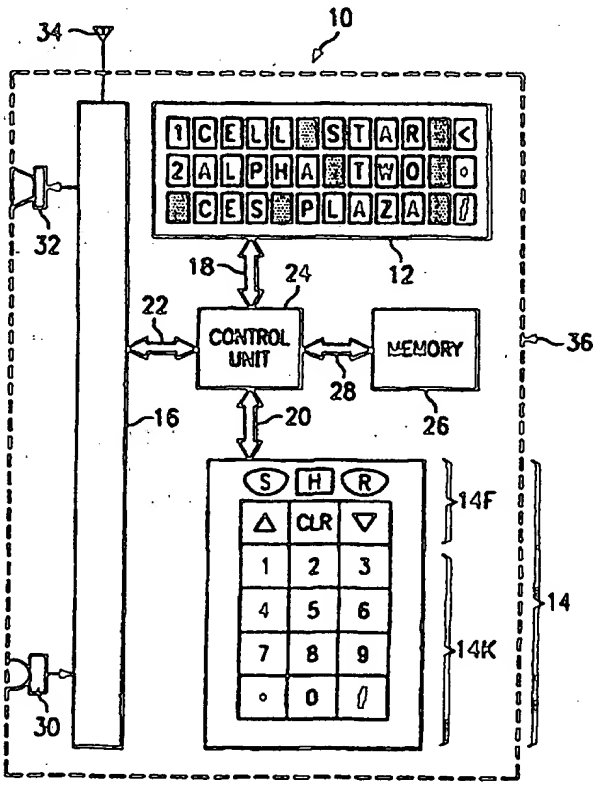
(57) Abstract

An English-language display unit (12) for use with mobile cellular phone units (10) is specifically configured to provide readily understandable status information to a cellular user operating in a multiple-server environment. The display unit is combined with a simplified user-operated server system prioritization capability, centered around a multiple-field display unit (12). The display unit/user prioritization interface combine to greatly reduce the complexity involved in understanding and managing the plurality of options available to the user in such an RF environment, while allowing full and personalized usage of the airtime servers present.



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DISPLAY AND USER INTERFACE OPERATION FOR USE IN A MULTIPLE SERVER ENVIRONMENT

Technical Field

The present invention relates generally to the display of status information and selection of particular 'servers' in a subscription RF communications environment of the cellular telephone type, wherein multiple 'server' systems are present. More particularly, the invention relates to an English-language (or other natural language), menu-driven display system that enables the cellular phone user to obtain a clear and simple overview of the present status of his radiophone unit, and of other options available to him by virtue of the multiple-server environment, and further to direct the radiophone unit to select predetermined server systems.

Background

With the advent of recent recommendations from industry associations such as TIA/EIA, there has been set forth in an Interim TDMA Cellular Standard IS-136 the possibility of several valid 'serving' systems to be available to the cellular user in a given mobile service area (MSA) at any given time. Beyond the two well-known present systems - a radio common carrier (RCC) designated generally as System A, and a wireline common carrier (WCC) designated generally as System B - a number of other system types are envisioned. These may include public, private, and residential cellular types, and may include more than one server of each type. The inclusion of personal communication systems (PCS) operating in the higher frequency bands may in the not too distant future further extend the number of servers users of multi-band cellular phone may encounter. A cellular phone user may have concurrent subscriptions on any of these systems, giving rise to an acute need for the average user to easily understand and handle the resulting complexity. Clearly, a simplified method of presenting, prioritizing,

and selecting the several server systems would be highly advantageous. This need is admirably met by the user display/selection system according to the present invention.

Descriptions of typical prior art approaches to earlier attempts to address the multiple-server situations may be found in a number of U.S. patents. U.S. Patent 5,442,806 to Barber et al. discloses methods and apparatus for selecting a particular cellular carrier based on a list of preferred system identification codes (SIDs) stored within the user's terminal. The approach appears to be set forth in terms of two servers, the well-known A and B providers of non-wire line and wire line services and produces status indicator lights in the form of graphic indicia denoting "in use," "no service," and "roam" conditions.

U.S. Patent 4,916,728 to Blair discloses the technique of allowing user prioritization and selection of individual cellular carrier signals, including the provisions of a basic status light display. The approach described essentially searches for Home SID or those SIDs that are not part of the exclusion list and simply actuates lights to display the information on the subscriber unit.

Other U.S. patents of general interest for their teachings of cellular or cellular-like communications in multiple-server environments are U.S. 5,276,905 to Hurst et al. and U.S. 5,020,091 to Krolopp et al.

Objects of the Invention

It is therefore a primary object of the present invention to provide an improved status display and server system selection capability for use with cellular phone units operating in a multiple-server environment.

A further object of the present invention is to provide methods and apparatus for implementing an improved display system that reduces the complexity

presented to the cellular phone user in a multiple-server environment.

A yet further object of the present invention is to provide methods and apparatus for implementing improved server system selection, wherein user-inputted and stored selection instructions are directly associated with their corresponding server listings to simplify subsequent selection and usage of available server systems.

A still further object of the present invention is to provide an English-language (or other natural language) display for a mobile cellular phone structured to present the user with readily understandable listings of what server systems are currently present and/or available in his MSA, plus current user-inputted selection status of each server, as well as the current operational status of the server systems listed.

A yet further object of the present invention is to provide means for entering and updating user-inputted instructions/data denoting the desired selection and prioritization of the multiple-server systems available, and also for entering and updating user or over the air-inputted notations regarding the server systems present.

The present invention addresses the problem of the enormously increased complexity presented to a cellular phone user as the number of serving systems are increased in a particular cellular geographic service area (CGSA or MSA) by providing a simplified display and user interface capability for presentation, selection, and prioritization of the multiple serving systems. The simplicity and usefulness of the solutions provided are centered around an English language (or other natural language), menu-driven display listing the several serving systems present, and two additional data fields per server - all of which informs and guides the user and his cellular phone unit after initial display/selection setup. The display also contains user-inputted instructions and

notations entered via the existing radiophone unit keyboard as supplemented by special function keys.

In an illustrative embodiment adapted for use with a portable hand-held cellular phone unit, alphanumeric text strings associated with each neighbor list sent by the separate serving systems to the cellular unit are entered, stored, and displayed as English-language (or other natural language) names of up to 15 characters. The term 'natural language' is defined for present purposes as a language having a regular written and spoken form in current usage, such as English, Swedish, Japanese, and the like. The server names are displayed in a central Alpha Tag field of the display, one name per display line. User-actuated keys serve to initiate the display/selection setup by entering alphanumeric characters or other indicia in an additional display field associated with each line. A "user settings" field denotes the user's instructions for each server, i.e., preferred priority rating; use this server only; never use this server; etc. A "current status" field indicates the radiophone system's knowledge or assessment of each server, i.e., system is present but user is not allowed on it, etc.

Brief Description of the Drawings

Additional objects and advantages of the invention will become apparent to those skilled in the art as the description proceeds with reference to the accompanying drawings, wherein:

FIG. 1 is a simplified block diagram of a cellular phone unit embodying the display/user selective features according to the present invention;

FIG. 2 shows a commercially available portable cellular phone unit amenable to incorporation of the features of the present invention;

FIG. 3 is a simplified plan view of a typical multiple cellular/PCS server or airtime provider environment;

FIG. 4 is a block diagram showing a preferred layout of a segment of the main system memory associated with supplying data to the display unit;

FIG. 5 is a flow chart showing an illustrative algorithm for facilitating data entry into the display unit memory;

FIG. 6 is a flow chart showing an illustrative algorithm used to determine the current status information for use in the display unit.

Best Mode for Carrying Out the Invention

Referring now to FIG. 1, there is shown a simplified block diagram of a cellular radiophone unit embodying the display/selection features according to the present invention. The overall cellular phone unit 10 is shown as including a display unit 12, an overall control key section 14, and a transceiver 16, all of which are interconnected via lines 18, 20, and 22, respectively, to a programmable control unit 24. A main memory unit 26 communicates via lines 28 with the control unit 24, while the transceiver 16 includes a microphone 30, a speaker 32, and an antenna 34. The control key section 14 includes a conventional keypad section 14K and a plurality of special function control keys 14F. A housing 36 carries all of the above elements plus other well-known and conventional items, such as batteries (not shown), and the like.

A cellular phone capable of incorporating the advanced features provided via the present invention is illustrated in FIG. 2. The unit pictured there as 10' is described in an Ericsson Inc. (of Research Triangle Park, North Carolina) Product Bulletin CEL 4001. With the exception of the memory configuration and the additional processing algorithms as described below (and possibly

some minor aspects of the display unit 12 and the special function keys 14F), the radiophone unit 10 of FIG. 1 may be structurally and functionally similar to the radiophone 10' of FIG. 2. A selected few of the major external elements of radiophone unit 10' corresponding to those of FIG. 1 are indicated by like identification numbers.

With reference again to FIG. 1, a brief functional overview of the operation of the radiophone unit 10 may be helpful at this point. Following this overview, a more detailed description of the major elements and their functions follows below. The main memory 26 is configured to contain programming information for directing operation of the radiophone unit 10 via the programmable control unit 24, as well as different areas for storing a "best list," probably blocks for 800 MHZ and 1900 MHZ operation, a current scan block, a home system list, service selection data, primary and secondary private system identification/residential system identification (PSID/RSID) lists, system identification (SID), and negative SID lists, system operator code (SOC) lists, and the like. Here, the "best list" of digital control channel (DCCH) is based on those control channels that the subscriber/user has successfully employed in the past. The value of probability blocks as aids to a radiophone unit in searching for a digital control channel is as defined in IS-136.1, in section 6.3.1 thereof. Section 6 of IS-136.1 is hereby incorporated by reference herein. The memory layout and display unit together allow a subscriber/user to quickly select the server system to which he has subscribed and/or server systems that he desires to use from among groups of server systems available in the local area. Additionally, a numeric assignment module (NAM) in which an installer technician stores, among other information, SIDs and SOCs corresponding to each provider/server of cellular airtime services that the owner of the radio-

radiophone unit 10 has subscribed to, and may be added to selected portions of the main memory 26.

The display unit 12 is arranged, in a preferred embodiment, as having three rows and twelve columns, each row divided into three fields. The first is a single character field indicating "user setting," the middle field of 10 characters is for the Alpha Tag consisting of 10 of the up to 15 alphanumeric characters allowed in section 6.5 of IS-136.1 associated with different system providers (alternately referred to also as servers or operators) name, and the third single character field in the 12th column holds the "current status" of each of the systems in operation. An example of the contents of the different character fields is shown in Table 1 below.

Table 1

Field Number	Character	Meaning
1 (first column)	#	User selects never to lock on to this system
	Blank	System found in the operational area but not in user's known systems list
	1–9	Priority setting of preferred order to lock on to known systems
	*	User selects this system only (others not selected, regardless of priority)
2 (columns 2–11) middle ten characters	Alpha Tag	System operator's name either entered at NAM programming or received over the air
3 (twelfth column)	#	System is present, but the user is not allowed to use it
	*	System is present in the operational area and is selectable
	<	User is currently locked to this system
	?	System is in user's "known" list but is not found to be present in this area

Those characters with special meanings in Table 1 are shown as illustrative only. Other characters or indicia (standard or custom) may also be used in their place. All characters displayed in the second or middle field

are considered herein to be alphanumeric, as distinct from purely graphic icons, and the like.

Continuing with the brief overview, a display menu is activated by operation of a "hot key," H (not shown), which may be included as one of the special function keys 14F. The key H functions to select the various display modes, one of which allows a user to selectively update information for the display unit 12. Upon having selected the appropriate display unit mode, the user can scroll up or down using selected up/down keys also included within the special function key group 14F. This allows the user to position any particular row and to make new entries in column 1 of the display 12, or to change the pre-existing entry in this column. Finally, by pressing an "enter" key E (not shown), which may also be one of the special function keys 14F, the data is entered in memory 26 and the user can be forced to lock to this system. Fine grain details of illustrative data associated with columns 1-12 of the display unit 12 are shown above in Table 1, where column 1 provides the priority of the system displayed in that row in columns 2-11, columns 2-11 providing the server's alphanumeric name or Alpha Tag.

Referring now to FIG. 3, a simplified plan view shows a typical multiple-server environment in pictorial form. As previously discussed, providers of cellular airtime services in a given MSA may include the well-known RCC and WCC servers, as well as residential, private, educational, and PCS servers. For simplicity of exposition, the few multiple servers are shown as having their service areas only partially overlapping - but it may be expected that a substantial portion of the MSA will be within the operational range of most, if not all, of the local servers.

An RCC cell site 50 is shown as connected to its associated MTSO, designated by the symbol " ", and thereafter to the local PSTN designated " " to provide

communications services to one or more subscriber/users via radiophone units 10. Similarly, a WCC cell site 52, connected to the PSTN via its MTSO as shown by like symbols provides communications services to a mobile subscriber/user 10** - while one of many possible other portable radiophone units 10* may be in communication with a residential (or private) cellular system 54. When one or more PCS sites 56 are operating, and additional services such as cell site 58 are available, the situation giving rise to the need for the capabilities of the present display/selection invention becomes clear. As usual, the interconnection between the various cell sites and their associated MTSOs, and between the MTSOs and the PTSN can be affected through the use of land lines, microwave links, or fiber-optic cables.

FIG. 4 provides an illustrative layout of that segment of main memory unit 26 that is dedicated to and tied up with the display unit 12. In this respect, it is only a part of memory 26 and thus is designated as 26D. Here a set of contiguous memory locations is associated with each and every system in which the user is interested. In addition to its Alpha Tag, possible data associated with each system may consist of SOC, SID, PSID, RSID, and the data associated with that particular subscription. The subscriber data may include type of service, Mobile Class, IMSID, and the like. Other information as desired may also be included.

Referring now to FIG. 5, there is shown a flow chart detailing an illustrative algorithm for data entry into the memory 26D associated with the display unit 12. Logic circuitry for executing the entry algorithm may be included as part of the control unit 24. The action is initiated via the "hot key" H that may function as a toggle to alternately select one or the other of two display modes - an active review/entry mode or a passive receive only/display mode. For a new entry to the display unit or for changing an old entry the user first

presses the "hot key" H and then with the help of "Up/Down" keys selects the appropriate row of interest. In the passive receive mode, whatever is received over the air and its corresponding stored data is displayed and the user will not be able to enter or modify the row data. While in the active review/enter mode, a user can enter, with the help of entries from key pad 14K, the priority of the system in column 1. Alpha Tags in columns 2 through 11 will also be displayed. These entries may also be made in NAM at the initial subscription time. At this stage if the user is satisfied with his data entry, he can press the "enter key" E, which appropriately stores this data in the memory 26D as described above. If the SOC is already in existence in memory, the appropriate set of memory locations in memory 26D will be over-written. A roaming user, should they receive the new SOC, will also have the capability to assign a priority to it by selecting an individual row and entering a new priority instruction/character in column 1. At this point the user can scroll to any new desired row and make similar changes, additions, etc. If the "hot key" H is not pressed, the display unit 12 will continue to display those legends associated with normal radiophone operations.

Before the various data items of the several servers are displayed, the radiophone unit must synchronize to those systems; that is, both time and frequency synchronization with those systems must be achieved. The algorithm used to determine the status information to be displayed executes a sequential process of locating valid signals in the area, synchronizing to the broadcast information streams, determining the level of interest based on that information, and optimally attempting "registration" with those that are of interest. The results of each of the steps may or may not produce and/or modify entries in the tabular data displayed to

the user. These processes may occur autonomously or may be selectively (re)initiated by the user.

Referring now to FIG. 6, there is shown an illustrative approach, in simplified form, for scanning the channels and making use of the information broadcast by the individual cellular system servers. The figure outlines a flow chart for determining current status of the various servers, and logic circuitry for executing the algorithm may be included as part of the control unit 24. As shown, two basic "entry" modes are possible; the first and most comprehensive occurs when the radiophone is first powered on. In this mode, all channels are possible candidates and an intelligent method may be used to limit the scope of the search in order to expedite the time to actually lock on to a channel and allow access. Briefly, programs executed within the control unit 24 (of FIG. 1) read all possible channels for signal strength, and rebroadcast information on the "next" strongest channel. Information channels that meet any of the user's criteria are save in memory portion 26D (FIG. 4) for display and/or later selection.

The second mode occurs all the time the radiophone unit is powered on. In this mode, the current channel (the one currently locked to and using for access) is automatically broadcasting information about its "neighbors." Using this information, the radiophone unit can selectively include or not include those broadcasts based on the user's priority inputs from the display review/entry mode.

Although the present display and user interface invention has been described in terms of selected preferred embodiments, the invention should not be deemed limited thereto since other embodiments and modifications will readily occur to one skilled in the art. It will of course be recognized that the memory layouts and operating algorithms described are merely exemplary, and many other equivalent layouts for control channel search,

based on the above description, may be utilized to expedite the lock-in process based on the user's subscription to the plurality of services available. It is therefore to be understood that the appended claims are intended to cover all such modifications as fall within the true spirit and scope of the invention.

Claims

Claim 1. A cellular phone display and user interface for use in a multiple-airtime server environment for providing a natural language status display, and for facilitating prioritized selection of selected ones of said servers, comprising:

a) means for receiving and storing alpha tags for two or more servers and for displaying said received alpha tags in natural language form in a second field of a multiple-field display;

b) means for facilitating user entry of server priority selection data for each of said received alpha tags into said storing means, for displaying in a first field of said display by reference to corresponding portions of said second field; and

c) means for providing the current system status of each of said received alpha tags via synchronization and decision logic for display in a third field of said display.

Claim 2. The display and user interface of Claim 1 wherein said means for receiving includes a cellular phone transceiver, and said storing means is a dynamically alterable memory, both of which are operated under the control of a programmable control unit in combination with a main memory device.

Claim 3. The display and user interface of Claim 2 wherein said means for displaying is configured as a plurality of rows and columns, each row dedicated to display two or more fields of data for a particular one of said multiple servers.

Claim 4. The display and user interface of Claim 1 wherein said user entry facilitating means includes at least one set of data entry keys and one set of special function keys operative in combination with an entry logic circuit portion of said control unit.

Claim 5. The display and user interface of Claim 4 wherein said current status providing means comprises a status logic circuit portion of said control unit executing an algorithm whose status output is displayed on a row corresponding to the alphanumeric display of its associated alpha tag.

Claim 6. The display and user interface of Claim 5 wherein said display comprises three rows and twelve columns, each row displaying at least one field of alphanumeric data.

Claim 7. The display and user interface of Claim 5 wherein said set of special function keys includes a "hot key" for enabling said entry logic circuit and one or more up/down keys for establishing by scrolling the particular row for user entry of said server priority selection data.

Claim 8. The display and user interface of Claim 5 wherein said multiple servers may include airtime providers designated as RCCs, WCCs, PSIDs, RSIDs, and PCSs, all of which may include up to 15 alphanumeric characters as part of their alpha tags.

Claim 9. The display and user interface of Claim 5 wherein said dynamically alterable memory may be included within said main memory device.

Claim 10. A method of displaying status information in natural language form for use in a mobile cellular phone unit and for facilitating user entry of priority data for selected particular airtime providers in a multiple-provider environment, comprising the steps of:

a) receiving alpha tags consisting of up to 15 alphanumeric characters by radio frequency means from at least one provider of airtime services;

b) storing in a dynamically alterable memory the received alpha tags and related identification data for said at least one provider;

c) displaying the alphanumeric data associated with one or more particular providers stored in said dynamic-

ally alterable memory in a multiple-line, multiple-field display wherein alphanumeric data for each particular provider is confined to a single field and a single line of said display;

d) enabling user-entered priority selection data for at least one provider into said dynamically alterable memory via entry key and logic circuit means for display in an alternate field of said display on the same line associated with the identification data of said provider; and

e) determining the operational status of any provider having an alpha tag or related alphanumeric data resident in said dynamically alterable memory via a current status logic circuit for developing a single character code representative of said status for display in yet an alternate field of said display on the same line associated with the identification data of said provider.

Claim 11. The method of Claim 10 wherein the step of enabling user-entered priority selection data includes the further step of providing means for scrolling successive lines of said multiple display to facilitate said entry enabling.

Claim 12. The method of Claim 10 wherein the step of enabling user-entered priority selection data includes the actuation of a single dedicated function key to initiate said entering and the actuation of one or more keys to enter priority data as a single character in said alternate display field.

Claim 13. The method of Claim 10 wherein the step of determining said single character status code further includes the step of displaying said status code in said yet alternate display field.

Claim 14. The method of Claim wherein the step of receiving said alpha tag and related identification data further includes the use of a memory device for

providing said system operating code or identification data for at least one provider of airtime services.

Claim 15. The method of Claim 10 wherein said multiple-line, multiple-field display provides at least three lines of English-language display in said cellular phone unit to facilitate its use in a multiple-server environment.

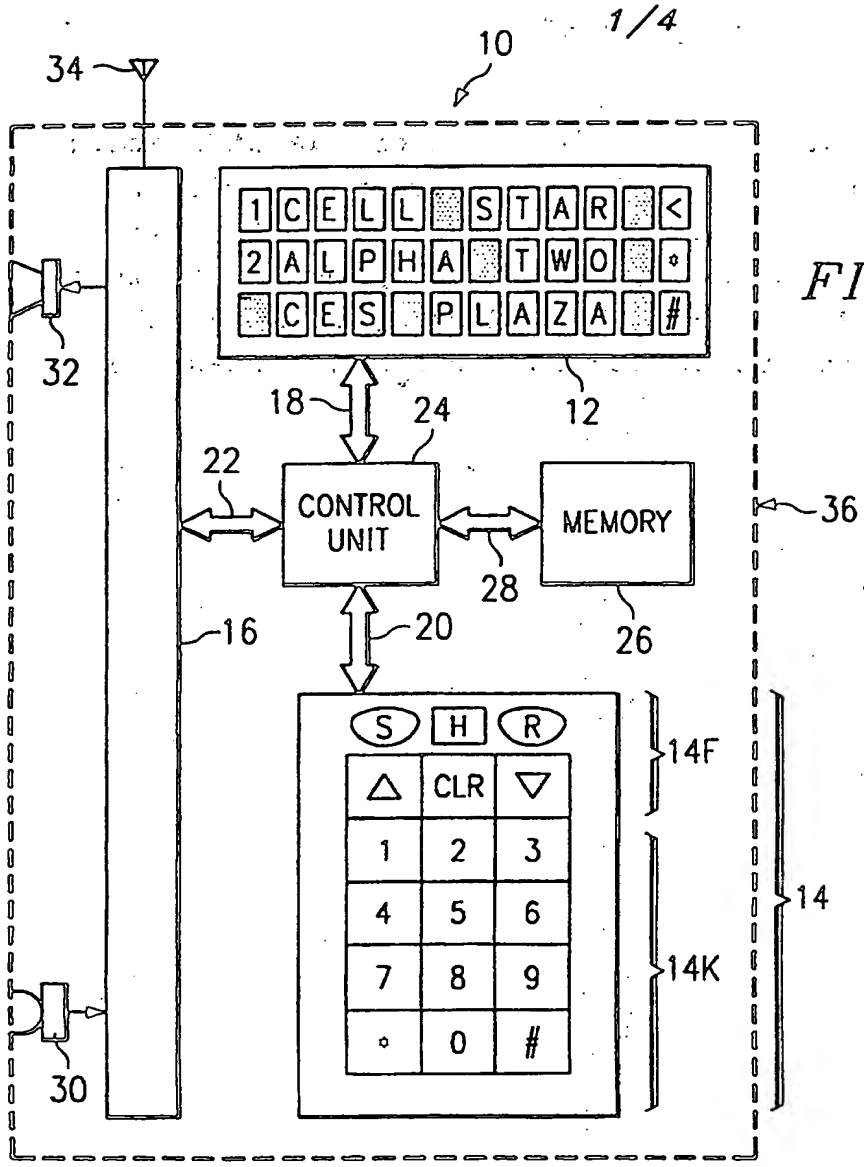


FIG. 1

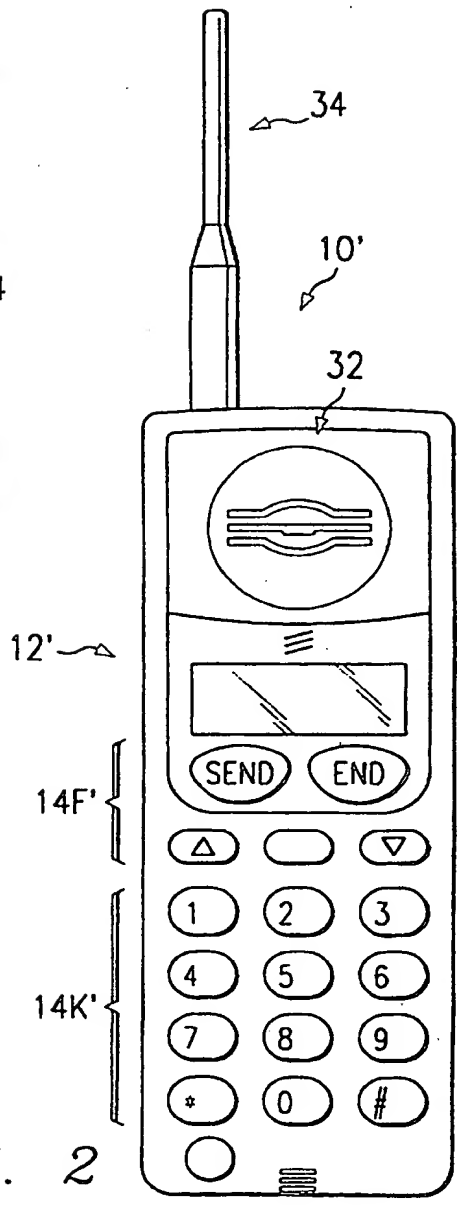


FIG. 2

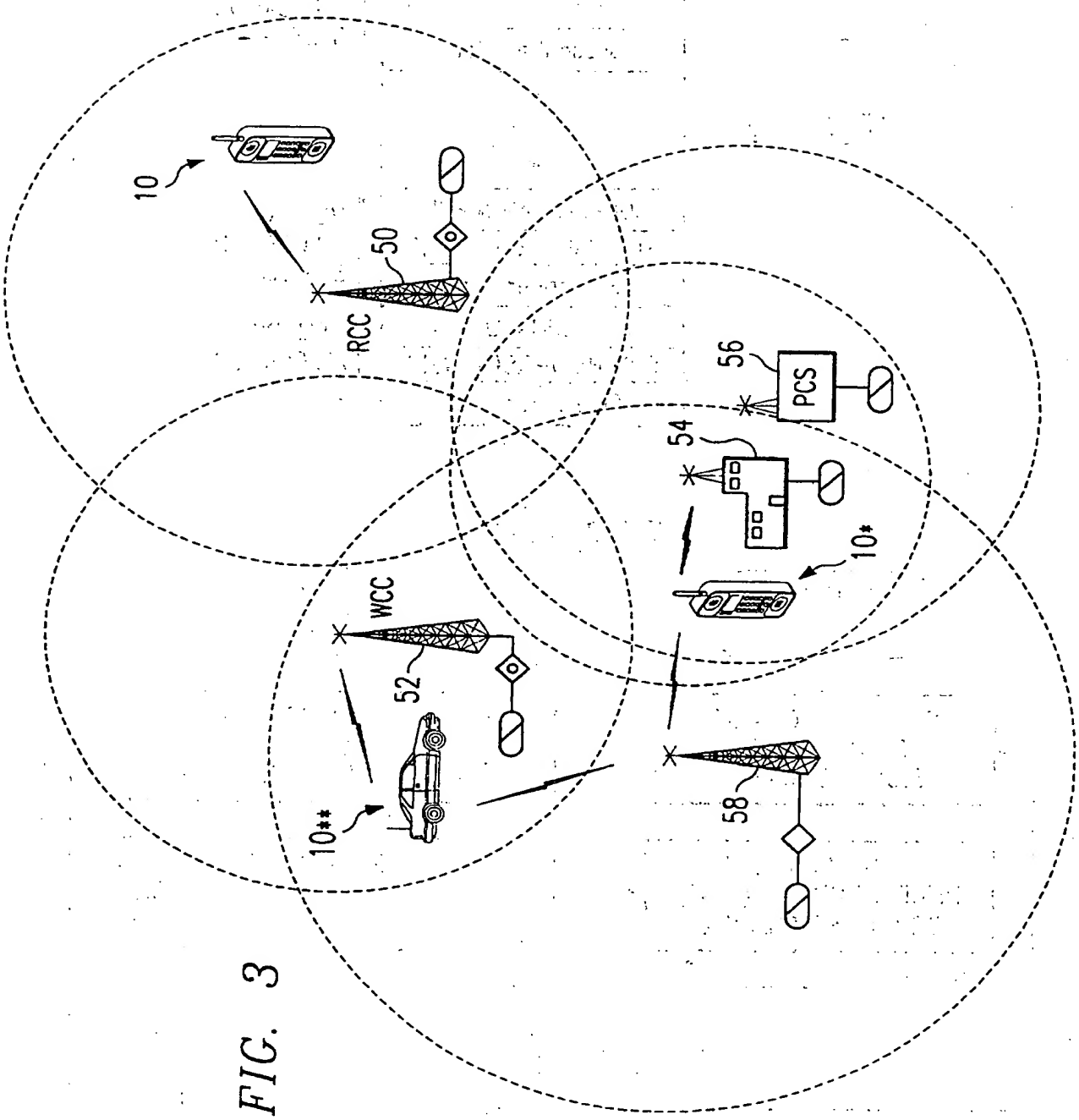


FIG. 3

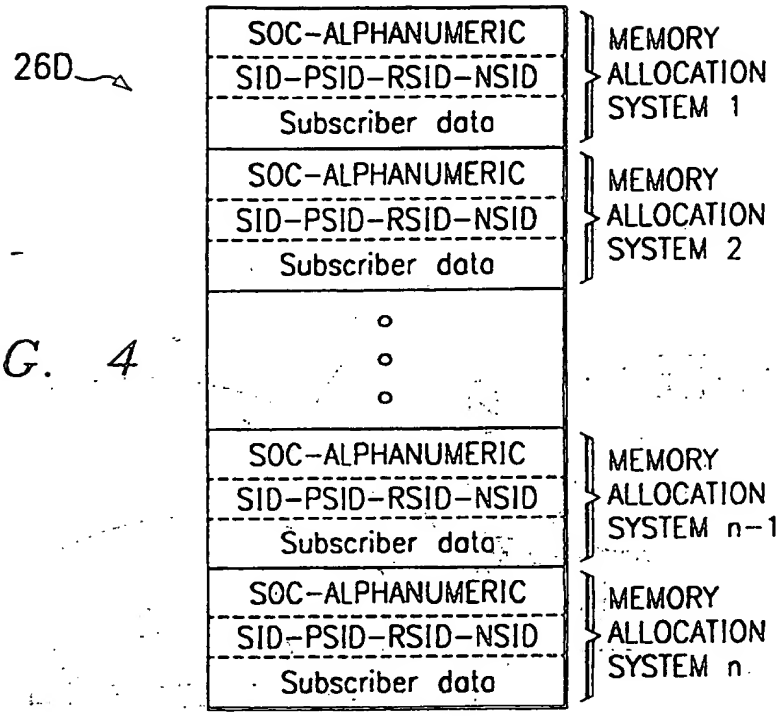
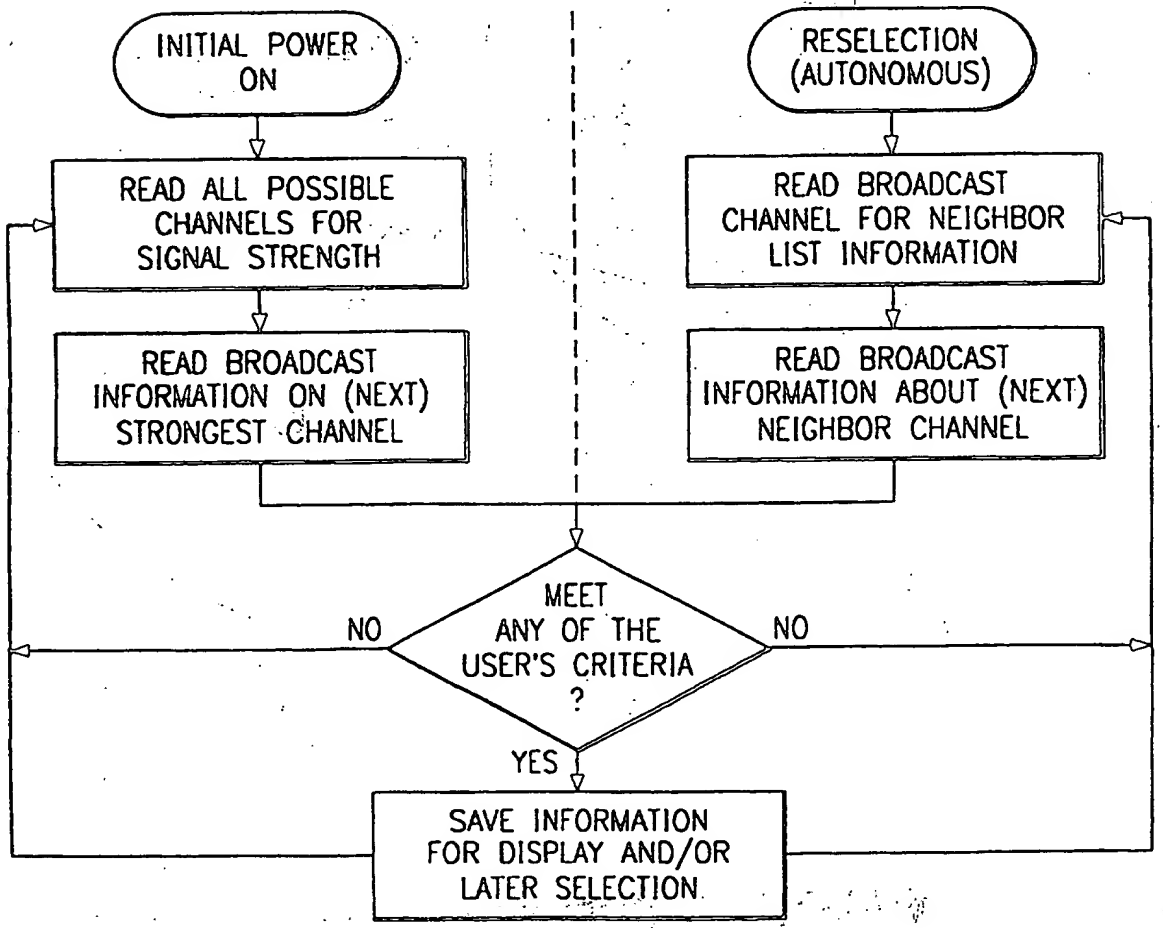


FIG. 4

FIG. 6



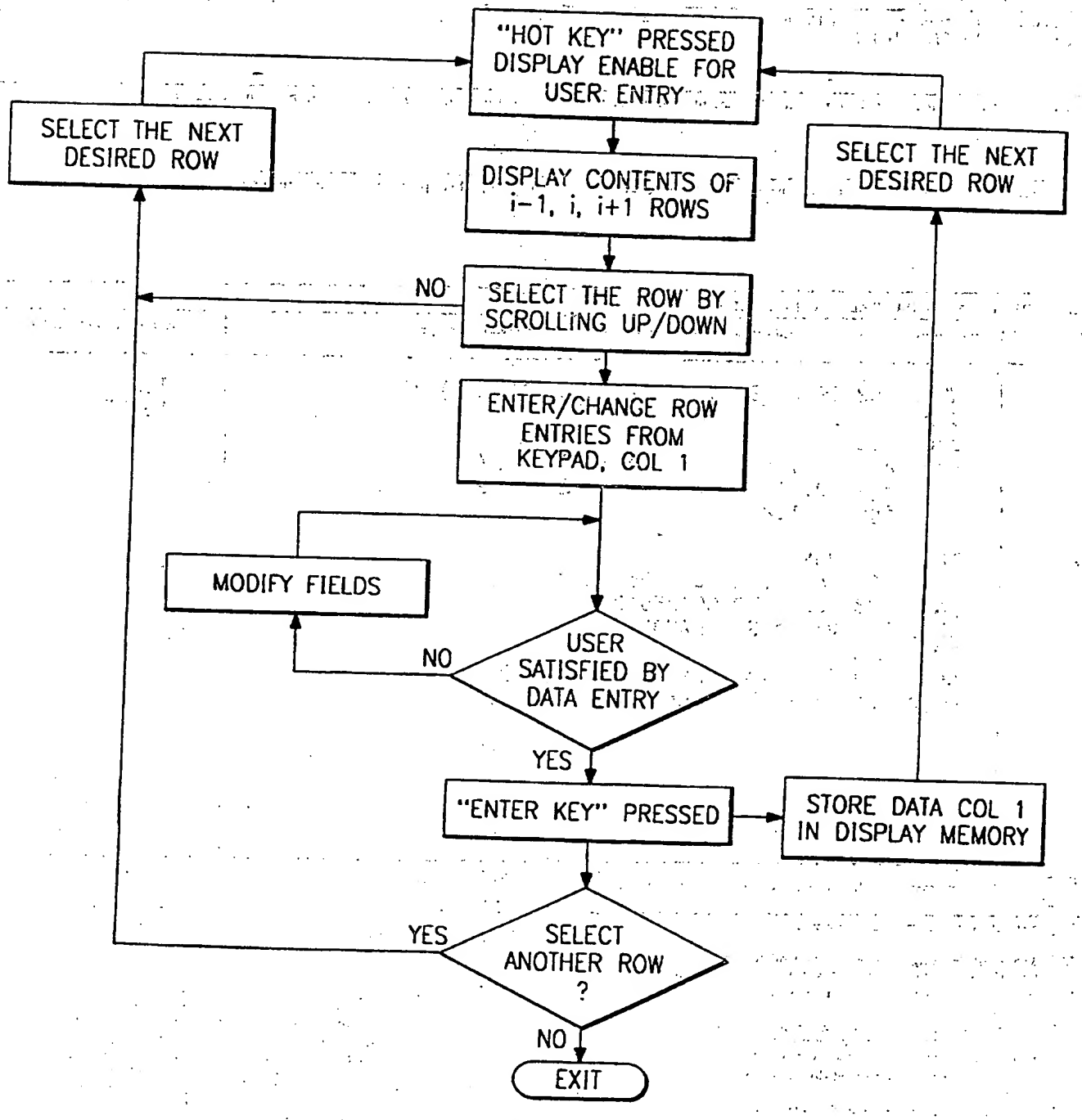


FIG. 5

INTERNATIONAL SEARCH REPORT

Inter nal Application No
PCT/US 97/06051

A. CLASSIFICATION OF SUBJECT MATTER
IPC 6 H04Q7/32 H04Q7/22

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 6 H04Q H04M

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	WO 95 02309 A (ERICSSON TELEFON AB L M) 19 January 1995 see abstract see page 5, line 2 - page 7, line 17 see page 10, line 17 - page 12, line 24 see figures 1,2 ---	1,2, 10-15
A	TELCOM REPORT, vol. 16, no. 6, 1 November 1993, pages 332-335, XP000425543 CHRISTAL P: "GSM-"HANDY" MIT TOP-HANDLING" see page 333, left-hand column, line 43 - page 334, left-hand column, line 45 --- -/--	1-7,10, 15

[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

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Date of the actual completion of the international search	Date of mailing of the international search report
28 August 1997	16.09.97

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax (+31-70) 340-3016	Schiwy-Rausch, G

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Inter. nal Application No
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C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 5 442 806 A (BARBER CLIFTON J ET AL) 15 August 1995 cited in the application see abstract; figures 1,2 see column 2, line 51 - column 3, line 31 see column 5, line 28 - column 6, line 20 see claim 1	1-8, 10-14
A	PATENT ABSTRACTS OF JAPAN vol. 095, no. 011, 26 December 1995 & JP 07 226974 A (NEC CORP), 22 August 1995, see abstract	1,10
A,P	US 5 586 338 A (LYNCH RICHARD ET AL) 17 December 1996 see abstract; figure 1 see column 1, line 57 - column 4, line 8 see column 4, line 42 - column 5, line 9	1,10

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Information on patent family members

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